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Adapting to the Changing Expectations of Software Industry: Graduate Readiness Training Program (GRTP)

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ABSTRACT

CONTEXT

The software industry has undergone significant changes in recent years, driven by the rapid advancement of technology. As a result, software companies have new and evolving requirements for the skills and knowledge of their employees. However, many computer science graduates have found it challenging to find employment in the software industry due to a mismatch between their skill sets and the requirements of the industry. In this study, to overcome these challenges a university in Bangladesh has initiated a special training program named Graduate Readiness Training Program (GRTP) with the collaboration of the software industry.

PURPOSE

The objective of this study is to investigate how a university can adapt and meet the changing expectations of the software industry through minimizing industry academia gap. The research question (RQ) we focused on in this study is “How to adapt to changing expectations of the software Industry?”

METHOD

This study collected data from the software industry through one-to-one interviews following a qualitative approach while collecting students’ feedback using a quantitative approach. After obtaining data from the software industry, their suggestions were incorporated into the Graduate Readiness Training Program (GRTP). On the other hand, we collected the university’s student data and performed an analysis on students’ data, and grades in specific subjects such as Data structure, Algorithm, Database, Web Framework and Object Oriented programming. This analysis helped to observe the students and further train them accordingly through the GRTP.

RESULTS

This study finds that continuous integration of industry feedback in the Graduate Readiness Training Program (GRTP) yields a higher degree of success with regard to student job placement. This study also finds that students with skills in data structure, algorithm and database have a high success rate when it comes to placement in the software industry. Additionally, students’ proficiency in web framework or object-oriented programming exhibit a higher likelihood of securing employment.

CONCLUSIONS

The GRTP is focused on the development of critical thinking, problem-solving techniques, computer programming, and software frameworks. The GRTP is bridging the gap between the skills possessed by computer science students and the requirements of the software industry. Industry needs are ensured by updating the GRTP based on the feedback from industry experts. Effectiveness of GRTP is continuously enhanced by incorporating industry feedback into program updates.

KEYWORDS
software Industry, education, industry academia collaboration, GRTP

Introduction

The software industry often perceives a significant gap between the knowledge and skills that academia imparts to its graduates and the real-world demands of the software sector (Barr, M et al., 2019). This industry-academia gap is characterized by a mismatch between the curriculum practiced in academic institutions and the rapidly evolving technological landscape of the software industry (Ntinda, M et al., 2021). Students enter the university through different admission systems or centralized admission systems (Johora, F. T. et al., 2022). There is a challenge observed post-graduation, with students often struggling to secure employment. The current problem is the substantial industry-academia gap where the existing educational syllabus fails to keep pace with the swiftly evolving needs of the software industry (Kiselev, A, 2023). As a result, many computer science graduates lack the necessary skills and understanding demanded by the industry, largely due to an outdated academic structure. This mismatch not only affects their job opportunities but also hampers the growth of the software industry because of a shortage of appropriately skilled workers (Tamrat, W, 2023). The purpose of this study is to explore how a university or an educational institution can meet the changing expectations of the software industry to bridge the existing industry-academia gap. Different initiatives can be taken to mitigate the gap like adjusting curriculum regularly, conducting additional training programs, and internships (Devitt, J et al., 2022). In recent years, the software industry has experienced rapid growth and evolution and Covid-19 also impacted the software industry (Islam, M. et al. 2023). Therefore, there is an increased demand for specific skill sets. However, computer science graduates struggle to find employment within the industry (Akdur, D, 2022). The motivation for this study comes from the need to bridge the gap and improve the job readiness of computer science graduates. With the evolving nature of the software industry, it becomes crucial for educational institutions to regularly update their curriculum to meet industry demands (Akdur, D, 2021). Despite ongoing efforts, there are several key challenges that still exist in bridging the gap between the software industry and academia. They are curriculum relevance, practical exposure or hands-on experience, industry engagement, soft skills and pace of change (Ranaraja, I et al., 2022). The research question we focused on in this study is “How to adapt to changing expectations of the software Industry?”. This study addresses the gap between the knowledge acquired by computer science graduates and the practical abilities that software firms require. To solve the industry academia gap, a university in Bangladesh implemented Graduate Readiness Training Program (GRTP). GRTP focuses on developing problem-solving skills which helps computer science graduates to prepare better for the software industry. GRTP program integrates feedback continuously from industry to ensure industry requirements and the effectiveness of the program.

Methodology

In this research study, we are dealing with the problem of adapting to changing expectations of the software industry and minimizing the software industry and academia gap. Computer science graduates are struggling to secure a job after graduation. To overcome this challenge, and minimize industry academia gap, the Graduate Readiness Training Program (GRTP) has been put into practice in a university of Bangladesh in the computer science department. GRTP is a four-week program which is specially designed for last year computer science students. This four-week program is designed to prepare students to meet the demands of the software industry. GRTP places emphasis on critical thinking, problem-solving skills, programming capabilities, understanding of data structures, algorithms, and software frameworks. In doing so, GRTP ensures that graduates are well-prepared to meet the challenges of the software industry. Despite the fact that the GRTP has been operational for under a year, the university is already getting its positive impacts. The university is observing substantial success in the employment rates of the students, showing the successful outcomes generated by the GRTP.

GRTP Framework

The process of the Graduate Readiness Training Program (GRTP) is fairly straightforward. The university gathers feedback from professionals in the software industry through one-on-one

interviews. These inputs are then passed on to the GRTP panel. The GRTP panel is responsible for updating the program's content to align with the industry's evolving requirements. With the curriculum refined, students undergo training based on the revised syllabus. After the training, they attend job interviews and often secure job placements in the software industry. Figure 1 depicts GRTP Framework.

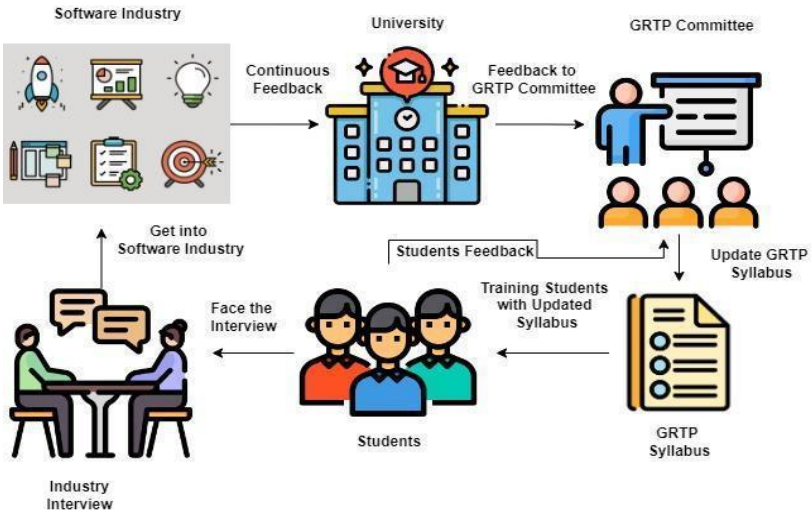

Figure 1. GRTP Framework

Kirkpatrick Model

The Kirkpatrick Model is a framework for evaluating the effectiveness of training and development programs (Kirkpatrick, J. 2015). In the context of GRTP, the four levels of the Kirkpatrick model are described below. Figure 2 shows the Kirkpatrick Model.

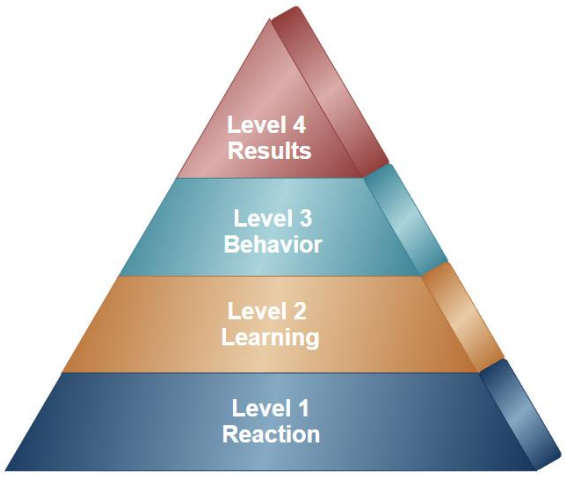

Figure 2. Kirkpatrick Model

Level 1 Reaction: In the context of GRTP, this level focuses on assessing how students react to the GRTP. We have collected data on their initial perceptions and satisfaction with the program that has been described in the students' feedback section of this paper.

Level 2 Learning: In the context of GRTP, this level assesses the extent to which participants have acquired new knowledge, and skills as a result of the GRTP. Students find GRTP helpful to enhance their knowledge and skills.

Level 3 Behavior: In the context of GRTP, this level evaluates how the skills and knowledge gained from the GRTP are applied in practice. It focuses on changes in behavior and job performance of the GRTP trainee.

Level 4 Results: In the context of GRTP, this is the highest level of evaluation. This level focuses on the actual impact of the GRTP on job placement and career success.

Data Collection and Analysis Method

In this study, the university or the GRTP body allowed us to access their training program, collecting students' feedback with some limitations and confidentiality. GRTP body also helped us in this study by providing students' data with some limitations and confidentiality. We have collected data through one-to-one interviews with professionals from the software industry. These interviews are designed to gather their opinions and insights about industry needs and requirements. The GRTP committee consisted of industry and academic advisors. Once the feedback is gathered then the GRTP committee evaluated the feedback and filtered out the suitable suggestions which were later incorporated into the GRTP program for the improvement. In this way, GRTP is gradually improving. As the university provided students' data to us for the research purpose. Therefore, we analysed students' data and their grades in specific subjects, such as data structures, algorithms, databases, and object-oriented programming. This analysis helps to identify areas where students may need additional training or support, which can be incorporated into the GRTP. After successful completion of GRTP by students, we surveyed students to get their feedback and provided it to the GRTP body. Students' surveys revealed that GRTP helped them to prepare better for the job interview and get into the job.

GRTP Outline

GRTP is a comprehensive four-week program. It features three types of sessions such as industry, technical and non-technical sessions. In the industry session, industry professionals share their experience about the work culture and practices of the software industry. In the technical session, students enhance skills like programming, data structures, algorithms and similar topics. In the non-technical sessions, students enhance soft skills like critical thinking and CV writing. At the very end of GRTP, students participate in interviews conducted by industry professionals right on campus. This provides them with a direct gateway into the software industry. GRTP authority did not share the detailed outline but a high level outline of their training program. Table 1 shows a high level GRTP Outline.

Table 1. High Level Graduate Readiness Training Program (GRTP) Outline

Session #	Theme	Topic	Expected Learning Outcome	Assessment/Evaluation
Session - 01	Industry Session-1	Industry Practices at different Software companies	Students are expected to learn about the industry practices at different software companies.	Students will not undergo assessment during this session, as it is an industry session.
Session - 02,03,04	Technical: Programming	Problem solving techniques (Beginner to advanced level)	Students are expected to solve programming problems ranging from beginner to advanced levels.	Students will be assigned three problems (number theory, combinatorics, linear algebra) and their on-site performance will be evaluated.
Session - 05,06,07	Technical: Data Structure	Data Structure (Beginner to advanced level)	Students are expected to learn and implement data structures from basic to advanced levels.	Students will be assigned three problems (array, linked list, hash table) and their on-site performance will be evaluated.

Session #	Theme	Topic	Expected Learning Outcome	Assessment/Evaluation
Session - 08,09,10	Technical: Algorithms	Algorithms (Beginner to advanced level)	Students are expected to learn and implement algorithms from beginner to advanced levels.	Students will be assigned three problems (graph, dp, greedy) and their on-site performance will be evaluated.
Session -11	Technical: Programming	Intra-university programming contest 1	Students are expected to apply their technical knowledge to solve real-world problems.	Students will be assigned 10 problems covering a variety of data structures and algorithms, and their on-site performance will be evaluated.
Session - 12,13,14	Technical: Database Management	Database Management (Beginner to advanced level)	Students are expected to learn and implement databases from beginner to advanced levels.	Students will be assigned to write various sql queries and their on-site performance will be evaluated.
Session - 15,16,17	Technical: Object Oriented Programming (OOP)	OOP (Beginner to advanced level)	Students are expected to learn and implement OOP concepts from basic to advanced levels in real-world Java projects.	Students will be assigned three problems covering various OOP concepts and their on-site performance will be evaluated.
Session - 18,19,20	Technical: Framework, Web & App Development	Framework, Web & App Development (Beginner to advanced level)	Students are expected to develop web and mobile applications from basic to advanced levels using frameworks.	Students will be assigned to develop interactive user interfaces with functionalities as an assignment and they will be evaluated later.
Session - 21	Technical: Programming	Intra-university programming contest- 2	Students are expected to apply technical knowledge to solve real world problems.	Students will be assigned 10 problems covering a variety of data structures and algorithms, and their on-site performance will be evaluated.
Session - 22,23	Non-Technical	Brain Training: How to use neurons and think effectively to solve complex engineering problems	Students are expected to apply learned techniques to solve complex engineering problems using proper thought process	Students will not undergo assessment during this session as it is a non-technical session.
Session - 24, 25	Non-Technical	CV Writing & guidelines for facing an interview	Students are expected to learn about CV writing and details about the industry interview and techniques to overcome that	Students will not undergo assessment during this session as it is a non-technical session.
Session - 26	Industry Session-2	Industry Practices at different Software Companies	Students are expected to learn about industry practices at different software companies from the industry experts	Students will not undergo assessment during this session, as it is an industry session.
Session - 27, 28	Campus Interview	Campus Interview	Students will face interview to different companies on campus	Students will sit for interviews to be recruited.

Results

RQ: How to adapt to changing expectations of the software Industry?

Adapting to the changing expectations of the software industry is a challenge as this industry is rapidly changing. In this study, we focused on the above research question and tried to investigate the solution with the help of a university by experimenting with the actual scenario. For the research

purpose, the GRTP authority provided us access to the students' data partially and to the training program and allowed us to conduct one survey, one to one industry interview with some limitations and confidentiality. In this study we took industry experts' feedback as well as students' feedback.

Industry Feedback

We conducted one to one interviews with the industry experts from different software companies in Bangladesh. Due to confidentiality, the detailed data of the software companies is not presented. However, the demographic data of the participants in one to one interviews are presented in table 2. Based on feedback from different software companies, essential skills for a potential employee include a strong background of data structures and algorithms with a strong theoretical foundation in computer science. Practical software development experience, adeptness in software frameworks, mastery in a minimum of one programming language, and well-developed soft skills such as communication and presentation. These competencies are crucial for success in the software industry and also serve as the core focus areas of the Graduate Readiness Training Program (GRTP). The gathered feedback from the software industry or summary of skills required by the software industry is presented in figure 3.

Table 2. Demographic data of the interview participants

Characteristics	Items	Frequency	Percentage
Gender	Male	31	83%
	Female	6	17%
Level of Education	Masters	26	70%
	Honors	11	30%
Size of Companies	Medium sized companies: More than 100 employees	33	89%
	Large sized companies: More than 500 employees	4	11%

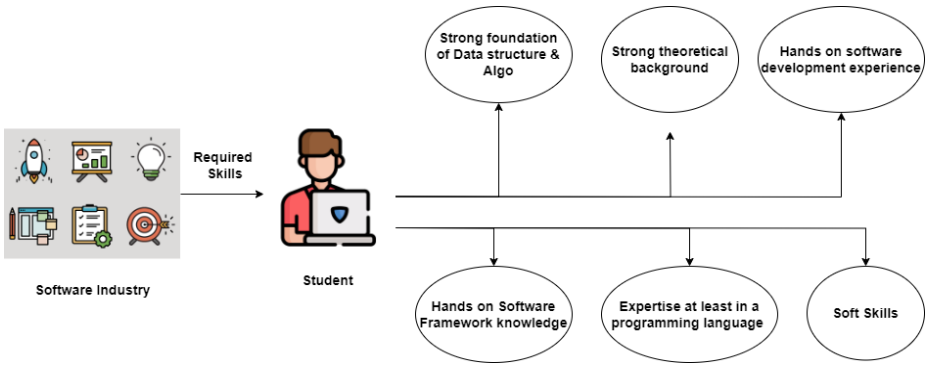

Figure 3. Feedback from different software companies

Students Feedback

We conducted a quick survey among a cohort of 25 students enrolled in the Graduate Readiness Training Program (GRTP), with the institution's approval. The participants were queried about the program's effectiveness in bolstering their technical skills like programming, improving their soft skills such as CV writing, and overall preparedness for internship or job interviews. The findings revealed that the majority, around 85% students, find the training program helpful to prepare for an internship or job interview. Students find this training program helpful also to prepare for technical interviews and to enhance their soft skills. The survey was conducted following a quantitative approach in a 5 point Likert scale format (Dawes, J. et al., 2008). The university allowed us to visit in a training session where a cohort of 25 students were present. Then we conducted a short survey within a specific limited time. Figure 4 presents students' feedback regarding the GRTP.

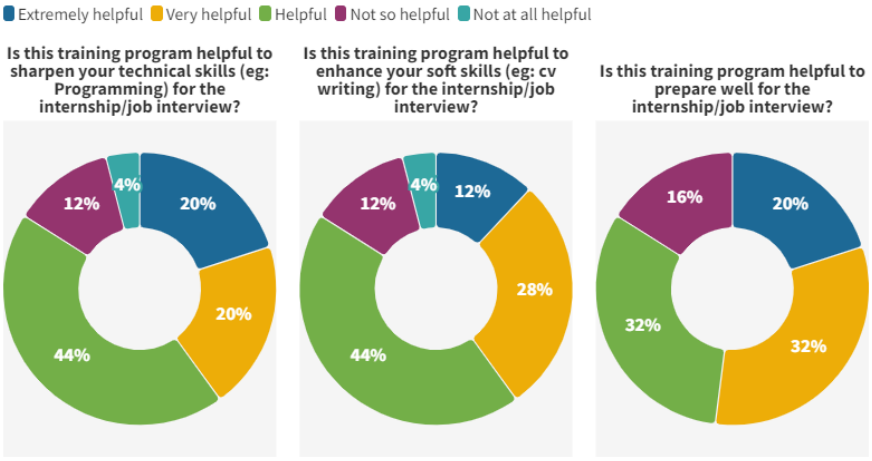

Figure 4. Students' Feedback Regarding GRTP

Case Study 1

The educational institution granted us access to the Graduate Readiness Training Program (GRTP) for the research purpose, allowing us to observe its operation on premises. According to our observations and the data shared with us, the institution has an impressive network of 35 industry mentors and 4 panellists that include top-level industry professionals such as CEOs, CTOs, Chairmen, Software Managers, Project Managers, and HR Heads. Though the GRTP is primarily conducted for final year students, the institution's strong industry connections sometimes lead to specialized training sessions as per industry requirements. In a case study, we found that a targeted training program for a specific software company led to the on-campus recruitment of 13 out of 27 trained students. The training sessions were customized based on the specific requirements provided by the software company to the educational institution. Figure 5 presents 27 students' GPA on specific subjects where 13 out of 27 got an internship/job offer on campus company interview. The GPA calculation for employed students in figure 5 as follows. *Average GPA = (Sum of GPAs of employed students in a specific subject) / (Number of employed students in that subject).* For unemployed students, the GPA is calculated in a similar way.

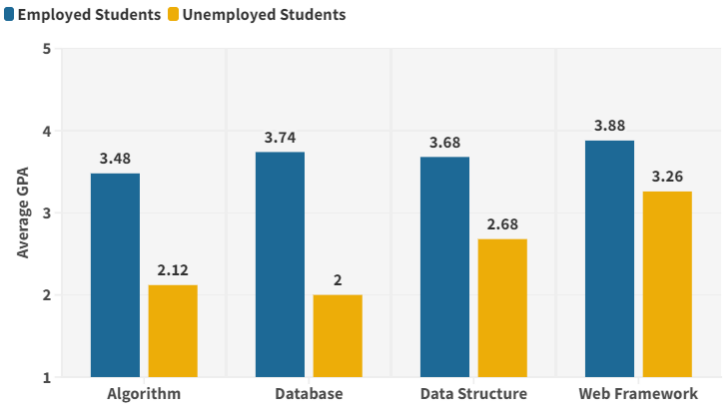

Figure 5. Students' GPA on Specific Subjects

Case Study 2

In another case study, we observed the employment outcomes for a batch of 32 students who completed the GRTP. Among these students, we found that more than half (56%) successfully secured job placements in various software companies right on a campus interview. This accounts for 18 students who were able to find employment opportunities immediately upon completion of the program. For this case study, we got the data of students' gpa for Object oriented programming (OOP) course, while for the case study 1 we got the data of Web framework.

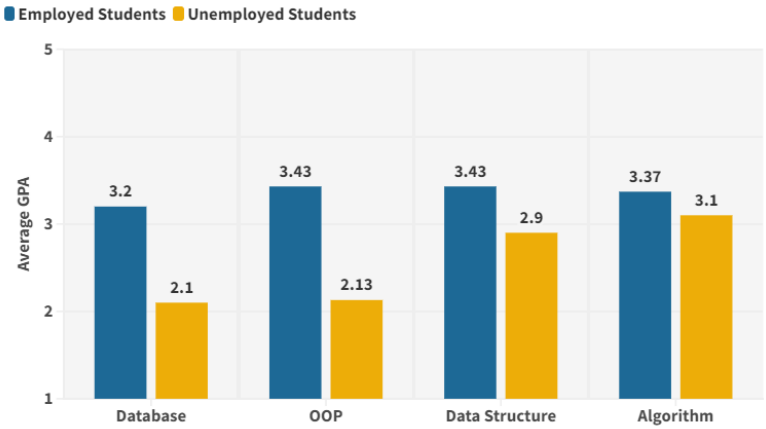

Figure 6. Students' GPA on Specific Subjects

Limitations

This research study has some limitations. The main limitation is access to the data. As the students' data are confidential to the university therefore, we got limited access to data. The other limitations are its geographical focus on one institution in Bangladesh might limit the applicability of the findings to other regions or cultures. The selection and size of the sample, along with the strong reliance on GPA as an indicator of skill, could skew results. The qualitative data obtained might be subject to the respondents' personal biases and interpretation subjectivity. Due to the rapidly evolving nature of the software industry, the findings may not stay relevant in the long term. We did not have full access to the data related to the GRTP program, Therefore, it might not be possible to evaluate the whole GRTP program.

Conclusion

This research study finds the effectiveness of the GRTP in addressing the skill mismatch between computer science graduates and the evolving needs of the software industry. The GRTP, initiated by an educational institution in Bangladesh, was designed through collaborative inputs from the industry. GRTP nurtures critical thinking, problem-solving skills, and proficiency in computer programming and software frameworks. This study revealed that proficiency in data structure, algorithms, databases, web frameworks, and object-oriented programming significantly increased students' chances of securing industry placements. The continuous integration of industry feedback into the GRTP is a crucial factor in enhancing the program's success and maintaining alignment with the industry's needs. The findings highlight the potential of industry-academia collaboration in shaping educational programs that effectively bridge the gap between academic training and industry requirements. In future, comprehensive training programs like GRTP can be implemented in other universities of Bangladesh. This may help other universities to get a good number of placements of their graduate students in the software industry. Though in this study we focused on the software industry, this kind of training program can be designed for other disciplines that would minimize industry academia gap.

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